DIRECT GAS BURNER TYPE FURNACE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a direct gas burner type furnace, for heating, capable of controlling an exhaust gas in accordance with the variation of heat load in the furnace.

2. Description of the Related Art

In the prior art furnace adopting a direct gas burner, for heating, which necessitates ventilation within the furnace, such as a dryer furnace for handling dangerous articles, the combustion rate of the gas burner is solely controlled in accordance with the variation of heat load of articles to be heated in the furnace. That is, if it is found that there is no article to be heated in the furnace as a result of the monitoring of the furnace temperature, an amount of gas to be supplied to the burner is automatically throttled to reduce the combustion rate.

A reason why the direct gas burner is employed is that the article can be effectively heated by using hot combustion gas for the purpose of directly heating the atmosphere within the furnace. However, the combustion gas directly introduced into the furnace must be exhausted from the furnace. It is also necessary to exhaust the furnace atmosphere containing dangerous material such as oil or others evaporated from the heated article after the concentration thereof becomes lower than a threshold value above which there is a risk of explosion.

In the prior art, even if a rate of the combustion gas introduced into the furnace varies in accordance with the increase/decrease of heat load, i.e., the increase/decrease of the combustion rate, an exhaust rate of a fan for exhausting furnace gas is constant.

Thereby, there is a problem in that, when the combustion rate decreases, the interior of the furnace becomes a negative pressure to suck outer air of a normal temperature from an opening of the furnace. Thus, the furnace temperature falls to increase the combustion rate even though the heat supply is unnecessary. In such a manner, in the prior art, there is no exhaust control of the furnace atmosphere due to the load variation, particularly for the purpose of energy-saving when the load decreases.

SUMMARY OF THE INVENTION

The present invention has been made to solve the above mentioned problems, and an object thereof is to provide a direct gas burner type furnace capable of maintaining the furnace temperature at a set temperature while decreasing a heat loss caused by the exhaustion, even if articles to be heated are not continuously introduced into the furnace, and also capable of saving energy as well as reducing an exhaustion amount of CO_2.

The inventive direct gas burner type furnace is adapted to control the combustion rate of combustion means based on a furnace temperature detected by a temperature sensor as well as to control an exhaustion rate of the combustion gas based on the combustion rate. As an amount of the combustion gas corresponding to that of the combustion gas introduced into the furnace is exhausted outside the furnace thereby, air of a normal temperature is not sucked from an opening of a furnace body into the furnace, whereby the furnace temperature does not fall. Accordingly, it is possible to reduce a heat loss due to the exhaust as well as to maintain the furnace at a set temperature, whereby energy saving and a reduction of the exhausted CO_2 are achievable.

The inventive direct gas burner type furnace may be provided with fans for circulating the combustion gas. Thereby, it is possible to make the furnace temperature uniform so that the articles to be heated are evenly

heated. Also, it is possible to accurately detect the furnace temperature to optimize the combustion rate and the exhaustion rate.

The inventive direct gas burner type furnace may comprise a plurality of combustion means. Thereby, it is possible to enlarge and elongate the size of the furnace. Also, it is possible to make it correspond to various situations by separate control of the off-operating combustion means and the on-operating combustion means.

The present invention may be more fully understood from the description of the preferred embodiments of the invention, as set forth below, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Fig. 1 is a schematic front view of an overall construction according to one embodiment of the inventive direct gas burner type furnace; and

Fig. 2 is a side view of a furnace body of the embodiment of the inventive direct gas burner type furnace.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One embodiment of the inventive direct gas burner type furnace will be described below with reference to the attached drawings. Fig. 1 is a schematic front view of an overall construction according to one embodiment of the inventive direct gas burner type furnace, and Fig. 2 is a side view thereof. Articles 13 are continuously supplied by a conveyor device 12, to a furnace body 1 of the direct gas burner type furnace according to the present invention, through an opening 1a provided in the furnace body. Gas burners 2 are attached to the furnace body 1 as combustion means for heating the articles 13 and internal structures of the furnace. While three gas burners 2 are provided in Fig. 1, the number of gas burners may be suitably selectable in accordance with the size of the furnace body 1.

Circulation fans 11 are provided within the furnace, for making the furnace temperature uniform by circulating the combustion gas in the furnace, and are driven by circulation fan motors 14 provided outside the furnace, respectively. The number of the circulation fans 11 is preferably equal to that of the burners. A temperature sensor 3 is provided in the furnace for monitoring the furnace temperature variable in accordance with the load variation due to the articles existing within the furnace, and transmitting information related to the furnace temperature to a temperature/output controller 4.

Combustion rate control means includes the temperature/output controller 4 and a damper control motor 5 connected to a gas feeding rate control damper 6 for adjusting a feeding rate of gas supplied to the gas burner 2 and to a combustion air feeding rate control damper 7 for adjusting a feeding rate of combustion air supplied to the gas burner 2. Accordingly, a signal representing the furnace temperature detected by the temperature sensor 3 is input to the temperature/output controller 4 which, in turn, creates a control signal based on the information input thereto and output the same to the damper control motor 5. The damper control motor 5 controls the gas rate control damper 6 and the combustion air control damper 7 based on the control signal. In such a manner, the combustion rate of the gas burner 2 is controlled.

Further, to exhaust the combustion gas introduced into the furnace, an exhaust duct 15 inserted into the interior of the furnace and connected to an exhaust fan 8 is provided. Exhaustion rate control means includes the temperature/output controller 4, a motor rotation controller 10 and an exhaust fan motor 9 for driving the exhaust fan 8. That is, information (a signal) representing the combustion rate of the gas burner 2 is transmitted from the temperature/output controller 4 to the motor rotation controller 10 which, in turn, controls

the exhaust fan motor 9 to regulate the rotational speed of the exhaust fan 8 based on this information. Accordingly, the exhaustion rate of the combustion gas is controllable in accordance with the combustion rates of the gas burner 2.

In this regard, in Fig. 1, front and rear chambers 16 and 17 provided adjacent to the furnace body 1 are suitably used in accordance with uses of the direct gas burner type furnace. For example, when the direct gas burner type furnace is used as a drier for drying coated articles, the front chamber 16 may be used as a coating chamber and the rear chamber 17 may be used as a cooling chamber. Or, both the front and rear chambers may be used as a preheating chamber and a cooling chambers, respectively, or as atmosphere-shutter chambers.

As described above, in the present invention, only the motor rotation controller 10 is newly provided for controlling the exhaust fan motor 9 and, by using the signal from the originally provided temperature/output controller 4, the exhaustion rate of the exhaust fan 8 is controlled to regulate the exhaustion rate of the gas burner 2 in correspondence to the combustion rate of the gas burner, that is, the rate of the combustion gas introduced into the furnace.

Accordingly, in the present invention, it is possible to automatically control the exhaust rate of the combustion gas in conformity with the combustion rate of the gas burner; i.e., the rate of the combustion gas introduced into the furnace; and in accordance with the variation of heat load due to the article to be heated in the furnace. Thereby, it is possible to suppress the unnecessary introduction of air due to an excessive exhaust in the prior art when the combustion rate is reduced, and to save energy as well as reduce the CO_2 exhaust rate.

While the invention has been described by reference to specific embodiments chosen for the purpose of

illustration, it should be apparent that numerous modification could be made thereto by those skilled in the art without departing from the basic concept and scope of the invention.